Mean Chlorophyll and Sea Surface Temperature for the United States Coastal Zone

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INTRODUCTION

The objective of this study was to obtain monthly mean-, seasonal mean-, and annual mean-chlorophyll and sea surface temperature for nine U.S. water regions within the US Exclusive Economic zone during the times that satellite data sets are available.

METHODOLOGY

Data

The satellite data sets used for this project are the “nine-kilometer” data sets from the SeaWiFS (Sea Wide Field-of-View Sensor) project and the Pathfinder program. Both data sets are binary image type data, mapped to equidistant cylindrical (Plate Carree) projection with 4096 pixels in longitude, and 2048 in latitude, nominally 9-km pixel height.

The chlorophyll data sets derived from SeaWiFS are bin-averaged from the 4-km global coverage to obtain monthly means processed by the NASA SeaWiFS Project (Code 970.2) and distributed by the NASA Distributed Active Archive Center (Code 902) at the Goddard Space Flight Center (http://seawifs.gsfc.nasa.gov). This is termed level 3 data in the SeaWiFS archive. We used level 3 data processed through SeaDAS 4.0, with chlorophyll obtained from the OC4v4 algorithm (O’Reilly et al., 2000). The data set covers the time period from September 1997 to February 2001. The chlorophyll algorithm not been validated for all regions, it is likely that each region may have a systematic bias of up

used, which covered a period from January 1985 to December 1998 (http://podaac.jpl.nasa.gov/). Both the day and night were processed to remove additional clouds using an erosion filter and subsequently averaged to monthly means as described in Casey and Cornillon (1999). Systematic errors are rare and the input data set will be within 1 degree of observed surface temperatures.

Pre-processing of Imagery

Before the regional mean values were obtained, seasonal and annual mean images were constructed.

Images of the seasonal means are the averages at each pixel of the appropriate monthly values. In this study, mean of seasonal means is defined as follows:

Spring: March, April, May
Summer: June, July, August.
Fall: September, October, November
Winter: December, January, and February

Seasonal mean image for each year is the average at each pixel of the following three monthly mean data

Spring of year x: March, April, May of year x
Summer of year x: June, July and August of year x
Fall of year x: September, October, November of year x.
Winter of year x: December of year x, January, and February of year x+1.

The annual mean image results from the mean of each pixel for all months in that year.

Regional Means

Regional areas were determined by distance offshore, then by geographic boundaries. The coastline is that which is resolvable at 9 km. The areas investigated are the coast to 25 miles (40 km), 25 miles to 100 miles (160 km), and 100 miles to 200 miles (320 km). The regions are shown in Figure 1 and Table 1.

A regional mean is the spatial mean of the chlorophyll or SST within the selected temporal mean image. For example, a winter 1999 chlorophyll value for the inner shelf of Northern California is the spatial mean of all the pixels in the Northern California region from the winter 1999 chlorophyll image.

Anomalies were also computed. We computed the anomaly at each pixel or the appropriate image (monthly, seasonal, annual), then determined the mean anomaly for the region. Our definition of anomalies is the difference between chlorophyll (or sst) for a month and the mean seasonal mean chlorophyll (or sst). i.e.,

$$\text{Regional anomalies}(m) = \sum^{n} (c_{i,m} - s_{i,m}) / n$$

REFERENCES

Casey, K.S. and P. Cornillon. 1999. A comparison of satellite and in situ based sea surface temperature climatologies, *Journal of Climate*, vol 12, no 6, pp. 1848-1863.

Kilpatrick, K.A., G.P. Podestá, and R. Evans. 2001, Overview of the NOAA/NASA Pathfinder algorithm for Sea Surface Temperature and associated Matchup Database. *Journal of Geophysical Research*, vol. 106, no. C5, pp. 9179-9197.

O'Reilly, J.E. et al. 2000. *SeaWiFS Postlaunch Calibration and Validation Analyses, Part 3*. NASA Technical Memorandum 2000-206892. Vol. 11, S.B. Hooker and E.R. Firestone, Eds. NASA Goddard Space Flight Center. Greenbelt MD.

Table 1.

Region	Bound 1	Bound 2
North Atlantic	Canada border	42 north
Middle Atlantic	42 north	36.5 north (VA-NC border)
South Atlantic	36.5 north	24.5 N, west of Key West
Gulf of Mexico	24.5 north (Florida)	Mexico
Southern California	Mexico	34.5 north (Point Conception)
Pacific Northwest	34.5 north	Canada
Hawaii	Hawaii	Niihau
Gulf of Alaska	British Columbia	west end of Aleutians (Attu Island)
Bering Sea	Aleutians	Yukon
Lake Superior	all	
Lake Huron	all (with Georgian Bay)	
Lake Michigan	all	
Lake Erie	all	
Lake Ontario	all	

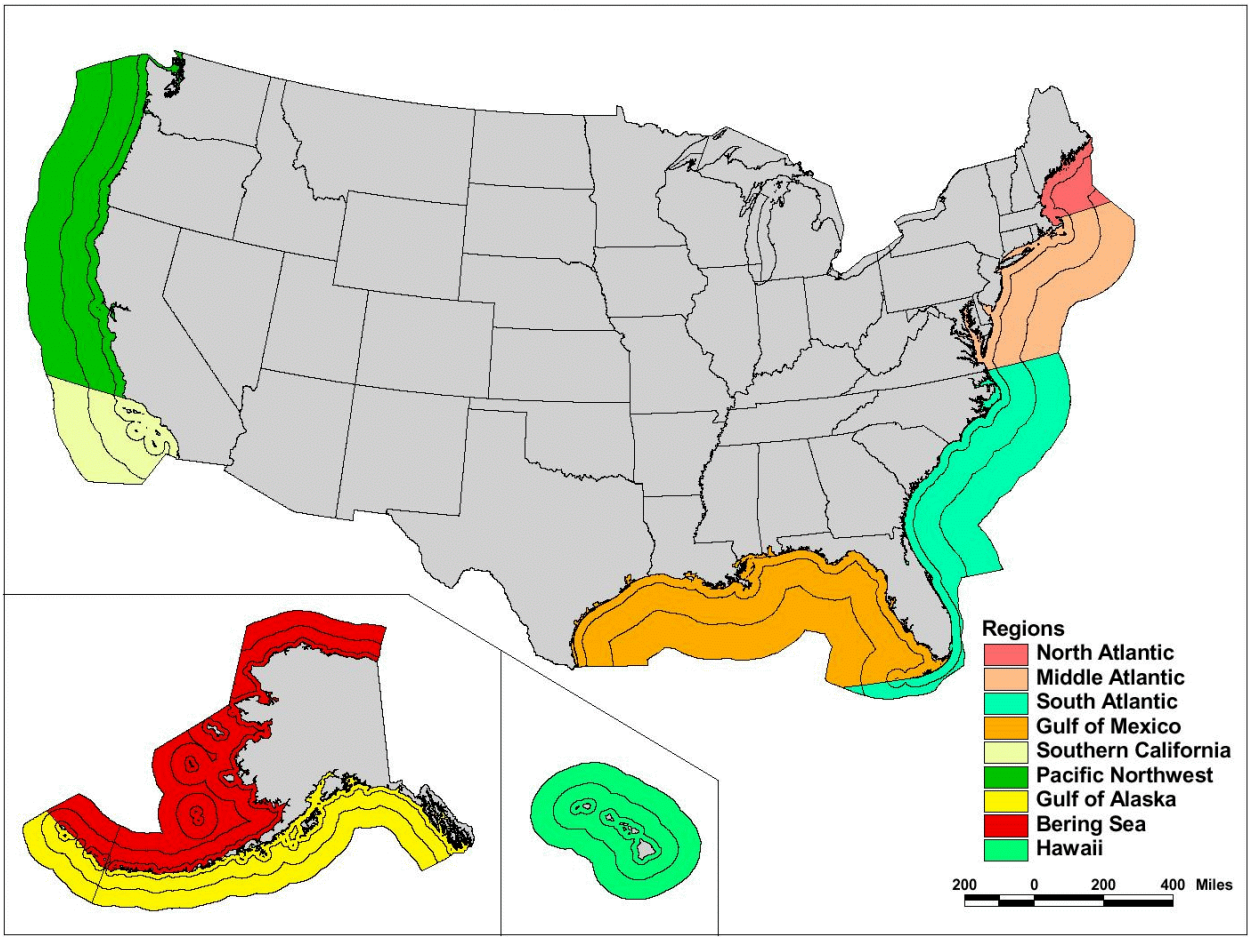

Figure 1. Regions for which means were determined.